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(54) **Engine exhaust emission purification device**

(57) A filter (1) collects particulates in an exhaust gas passage (22). The pressure loss of the filter (1) and the exhaust gas flow rate of the engine are detected, and an oil ash deposition amount on the filter is estimated. A filter regeneration determination value is set from the oil ash deposition amount and the exhaust gas flow rate. The filter regeneration timing is determined by comparing the differential pressure of this filter (1) with a regeneration determination correction value, and when it is determined that it is time to regenarate, the exhaust gas temperature is increased and regeneration of the filter (1) is performed. In this way, the filter regeneration timing is precisely determined regardless of the oil ash deposition amount, appropriate exhaust gas purification is performed, and impairment of fuel cost-performance is suppressed.

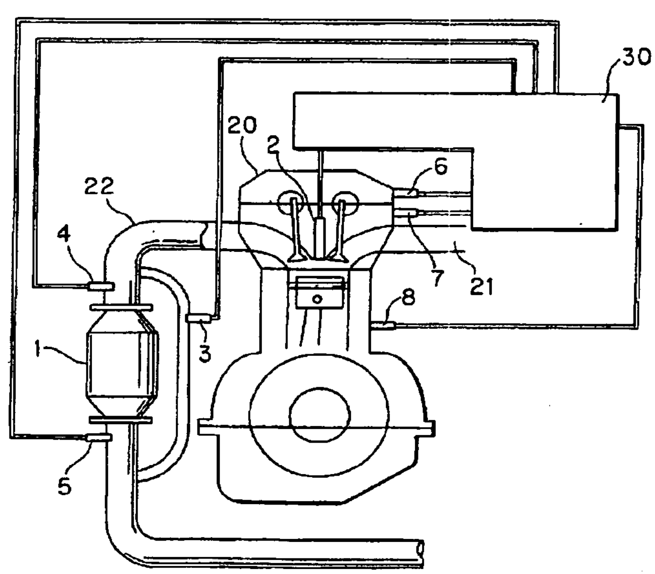

FIG.1

Description

FIELD OF THE INVENTION

[0001] This invention relates to an exhaust emission purification device which processes the exhaust gas particulate of a diesel engine.

BACKGROUND OF THE INVENTION

[0002] In order to process the exhaust gas particulate discharged from a diesel engine JP-A 7-11935 proposes disposing a filter in an exhaust system.In this case, if the particulate collection amount (mainly carbon particles) in the filter increases, the resistance of the passage will increase and the exhaust gas pressure loss of the engine will increase.

[0003] Thus, when the collection amount of the particulate in the filter reaches a predetermined amount, the filter temperature is raised by a heater to burn the collected particulate and regenerate the filter.The regeneration time is determined based on the exhaust gas differential pressure upstream and downstream of the filter, and when the differential pressure exceeds a set value, it is determined that it is time to regenerate the filter.

SUMMARY OF THE INVENTION

[0004] When engine oil burns, oil ash is produced although in very small amount. If the oil ash included in the exhaust gas deposits on the filter, even if not much particulates have actually collected on the filter, the above-mentioned differential pressure will become large. Oil ash cannot be burnt like particulates, and its deposition amount increases gradually with the elapsed running time. For this reason, if deposited oil ash on the filter is ignored, the determination of filter regeneration time will be incorrect.heat energy is required to raise the temperature during filter regeneration, but if unnecessary regeneration operations are repeated, fuel cost-performance will be impaired.

[0005] It is therefore an object of this invention to correctly determine the regeneration time of a filter, appropriately perform exhaust gas purification and reduce the loss of fuel cost-performance as far as possible.

[0006] In order to achieve the above object this invention provides an engine exhaust purification device for a vehicle engine having a filter which collects particulate in an exhaust passage. The device comprises a sensor which detects a differential pressure upstream and downstream of the filter, a sensor which detects an exhaust gas flow rate, a device which raises the exhaust gas temperature upstream of the filter, and a controller which functions to: estimate an oil ash deposition amount on the filter, set a regeneration determination value which performs regeneration of the filter based on the oil ash deposition amount and exhaust gas flow rate, and increase the exhaust gas temperature upstream of the filter to perform regeneration of the filter when it is determined that it is time to regenerate the filter by comparing the detected differential pressure and the regeneration determination value.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Fig. 1 is a schematic block diagram showing one embodiment of this invention.

[0008] Fig. 2 is a flowchart describing the control of this invention; Fig. 2(A) is a main routine and Fig. 2(B) is a subroutine.

[0009] Fig. 3 shows the characteristics of exhaust gas flow rate based on engine load and engine rotation speed; Fig. 3(A) is a natural intake engine, and Fig. 3 (B) is a turbo charged engine.

[0010] Fig. 4 is a descriptive drawing showing regeneration starting and stopping characteristics.

[0011] Fig. 5 is a diagram showing the characteristics of correction values for regeneration starting and stopping determination values based on running distance.

[0012] Fig. 6 is a diagram showing oil ash deposition amount and filter pressure loss characteristics based on running distance.

[0013] Fig. 7 is a diagram showing particulate collection amount and filter pressure loss characteristics, by comparing an initial state with the state after deposition of oil ash.

[0014] Fig. 8 is a diagram showing filter pressure loss variation characteristics due to a filter regeneration operation.

[0015] Fig. 9 is a diagram showing particulate collection amount and combustion rate characteristics during filter regeneration.

[0016] Fig. 10 is a diagram showing the characteristics of correction values of regeneration starting and stopping determination values based on the filter inlet and outlet temperature.

[0017] Fig. 11 is a diagram showing filter inlet and outlet temperature characteristics due to regeneration.

[0018] Fig. 12 is a diagram showing the characteristics of correction values of regeneration starting and stopping determination values based on regeneration time.

[0019] Fig. 13 is a characteristic diagram showing the particulate discharge amount based on the engine rotation speed and load.

[0020] Fig. 14 is a diagram showing the characteristics of correction values of regeneration starting and stopping determination values based on the particulate collection amount.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] An embodiment of this invention will now be described referring to the drawings.

[0022] First, in Fig. 1, 20 shows a diesel engine which

has an intake passage 21 and an exhaust passage 22.

[0023] A filter 1 which collects particulates in the exhaust is installed in the exhaust passage 22.

[0024] A controller 30 is provided which regenerates the filter 1 when the particulate collection amount of the filter 1 reaches a predetermined value.

[0025] The controller 30 comprises a microprocessor, memory and input/output interface.

[0026] A differential pressure sensor 3 is installed in a differential pressure detection passage which bypasses the filter 1 in order to detect the exhaust gas differential pressure upstream and downstream of the filter 1, and temperature sensors 4, 5 are installed to detect the inlet and outlet temperatures of the filter 1, respectively.

[0027] An engine rotation speed sensor 6 and engine load sensor 7 are provided to detect the engine exhaust gas flow rate, and a running distance sensor 8 is provided to detect the running distance of the vehicle.The outputs of these sensors are sent to the controller 30. Based thereon, the particulate collection amount of the filter 1 is determined and regeneration of the filter 1 is performed with a predetermined timing, as described later.

[0028] The regeneration of the filter 1 is performed by raising the exhaust gas temperature, by delaying the fuel injection timing of the fuel injected from the fuel injector (for example, common-rail fuel injector) 2 of the diesel engine 20 compared to the fuel injection timing during ordinary running, or by performing an additional injection once after the ordinary injection.

[0029] Fig. 2 is a flowchart for performing regeneration in the controller 30; (A) shows the main routine, (B) shows a subroutine. These are repeatedly performed at a predetermined interval.

[0030] The regeneration of the filter 1 will be described according to this flowchart.

[0031] First, the subroutine (B) for correction of the regeneration determination value will be described.

[0032] In a step S11, a differential pressure ΔP upstream and downstream of the filter 1 is read from the output of the differential pressure sensor 3, and in a step S12, the engine rotation speed and load are read from the output of the rotation speed sensor 6 and the load sensor 7.

[0033] In a step S13, the exhaust gas flow rate is computed according to the map of Fig. 3 based on the engine rotation speed and load.Fig. 3(A) shows the characteristics of a natural intake engine, and Fig. 3(B) shows the characteristics of an engine with a turbocharger.

[0034] The differential pressure upstream and downstream of the filter 1 increases as the particulate collection amount increases, but it fluctuates according to the exhaust gas flow rate at that time, and for an identical collection amount, the differential pressure becomes larger the higher the exhaust gas flow rate becomes.

[0035] In a step S14, a regeneration starting determination value which is a pressure value when regeneration starts, and a regeneration stopping value which is a pressure value when regeneration stops, are read from a table as shown in Fig. 4 which sets the regeneration determination values based on the amount of exhaust gas flow rate at that time.

[0036] The regeneration determination value is set as a value equivalent to a pressure value when the particulate collection amount reaches a predetermined value.

[0037] The filter pressure loss at regeneration starting, i.e., the upstream/downstream differential pressure, is large, and by comparison, the differential pressure at regeneration stopping after particulate combustion falls. Therefore, the regeneration determination values are set correspondingly.

[0038] The regeneration starting determination value and regeneration stopping determination value become larger as the exhaust gas flow rate increases.Next, in a step S15, the running distance of the vehicle is read from the output of the running distance sensor 8, and in a step S16, based on this running distance, the regeneration starting determination value and regeneration stopping determination value are corrected.

[0039] If oil ash generated by combustion of engine oil is contained in the exhaust and this oil ash deposits on the filter 1, the differential pressure upstream and downstream of the filter 1 will increase according to the oil ash deposition amount. The oil ash does not burn when the filter is regenerated. For this reason, the oil ash deposition amount increases the longer the engine running time.

[0040] Thus, it will be considered that, by correcting the aforesaid determination values according to the oil ash deposition amount using the correction values, **Kmax, Kmin** set by a table as shown in Fig. 5, these corrected determination values depend on the actual particulate collection amount collected in the filter 1. A regeneration starting determination value **PHmax** is calculated as a basic value (initial value) **Pmax+** correction value **Kmax,** and the regeneration stopping determination value **PLmin** is likewise calculated as a basic value (initial value) **Pmin+Kmin.** However, it is also possible to compute the regeneration determination values by multiplying the basic values by correction values.

[0041] As the oil ash deposition amount increases according to the running distance of the vehicle, the correction values **Kmax, Kmin** are both values which increase according to the running distance. The regeneration starting determination value and regeneration stopping determination value after this correction are shown by the dot-and-dash line of Fig. 4, and they are both large values compared with the values before correction.

[0042] As shown in Fig. 6, the amount of oil ash deposited on the filter 1 increases according to the running distance of the vehicle, so the filter 1 gradually becomes clogged and filter pressure loss increases.

[0043] Thus, the filter suffers pressure loss due to collected particulates and also due to deposition of oil ash,

so by adding the pressure loss due to this oil ash to the pressure value for determining regeneration starting and stopping, determination correction values depending on the paniculate collection amount can be precisely computed.

[0044] Next, regeneration control of the filter will be described according to the main routine of Fig. 2(A). This control is performed while reading the execution result of the above-mentioned subroutine.

[0045] In a step S1, the magnitudes of the differential pressure Δ**P** upstream and downstream of the filter 1 and the regeneration starting determination value **PHmax** are compared, and the regeneration starting time is determined. When the differential pressure ΔP is larger than the determination value PHmax, it is determined that it is time for the filter to be regenerated, otherwise, the routine returns to its original state.

[0046] When the pressure loss of the filter 1 increases and it is determined that regeneration has started, the routine proceeds to a step S2 and it is determined whether or not the present running condition satisfies regeneration conditions. When regeneration conditions are satisfied, such as when the engine is running in the steady state, the routine shifts to regeneration control in a step S3. When the regeneration conditions are not satisfied, the system waits for a running state when the regeneration conditions are satisfied.

[0047] In the regeneration control of the step S3, the fuel injection timing of the fuel injected from the fuel injector 2 is relatively delayed, or the combustion in the engine is delayed from the regular state by injecting once again after the injection with the usual fuel injection timing, so as to raise the exhaust gas temperature, and the particulates collected by the filter 1 are thereby burned.

[0048] In a step S4, the differential pressure Δ**P** upstream and downstream of the filter 1 is compared with the regeneration stopping determination value **PLmin,** and regeneration control is continued until the differential pressure Δ**P** becomes less than the regeneration stopping determination value **PLmln**. When, due to combustion of particulates, the differential pressure upstream and downstream of the filter 1 falls to less than the regeneration stopping determination value PLmin, it is determined that the regeneration stopping time has been reached, and regeneration control is stopped.

[0049] Next, the overall operation will be described referring to Fig. 7-Fig. 9.

[0050] The particulate contained in the exhaust from the engine are collected on the filter 1, and their discharge to the outside atmosphere is prevented. As the particulate collection amount increases, the filter 1 becomes clogged, and the upstream/downstream differential pressure gradually becomes large.

[0051] When the differential pressure becomes large, exhaust gas pressure loss will increase and the performance of the engine will be impaired. Hence, when the collected particulates exceed a predetermined amount, regeneration of the filter 1 is performed.

[0052] The determination of the regeneration time is performed based on a comparison of the regeneration starting pressure based on the exhaust gas flow rate at that time, and the upstream/downstream differential pressure (pressure loss) of the filter 1.

[0053] The pressure loss of the filter 1 becomes large the more the particulate (PM) collection amount increases, and this pressure loss increases relatively due to deposition of oil ash, as shown also in Fig. 7. Initially, when the vehicle running distance is small, there is little deposition of oil ash, but when the running distance increases, the oil ash deposition amount will increase. Hence, the amount of oil ash deposited on the filter 1 is estimated according to the running distance, and the regeneration starting determination value and stopping determination value are corrected based on this estimate.

[0054] Therefore, these corrected determination values contain an oil ash deposition fraction, and by comparing this with the pressure loss of the filter 1, a precise determination of regeneration starting time and regeneration stopping time reflecting the actual particulate collection amount can be made.

[0055] Fig. 9 shows the regeneration of the filter 1, and the resulting pressure loss state of the filter 2, when the regeneration determination values have been corrected relative to the oil deposition amount on the filter 1 (dot-and-dash line in the figure), and when the regeneration determination values have not been corrected relative to the oil deposition amount on the filter 1 (dotted line in the figure).

[0056] As seen from this figure, in the filter initial state shown by the solid line in the figure, the determination value (differential pressure) for filter regeneration starting and the determination value for regeneration stopping are low, whereas, the determination values are relatively higher due to correction after oil ash deposition.

[0057] Therefore, regeneration starting and stopping correspond precisely to the actual particulate collection amount of the filter 1, and for this reason, the regeneration time is effectively set.On the other hand, if correction is not performed despite the deposition of oil ash, even if the actual particulate amount does not reach the amount at which regeneration is necessary, as there is a pressure loss due to the deposition of oil ash, the differential pressure upstream and downstream of the filter 1 rapidly attains the regeneration starting determination value.

[0058] In this case, the particulate collection amount decreases to less than in the steady state. As shown in Fig. 8, the combustion rate varies due to the particulate collection amount, and the combustion rate decreases, the less the collection amount becomes. Hence, the time required for regeneration increases, and the fuel-cost performance deteriorates by a corresponding amount.That is, if the combustion rate falls, particulates do not burn easily, and it takes time for the differential

pressure of the filter 1 to fall to the regeneration stopping determination value.

[0059] However, in this invention, by estimating the oil ash deposition amount and applying a correction, the particulate collection amount can be determined correctly, the regeneration time is always accurately, and deterioration of fuel cost-performance is suppressed.

[0060] Next, another embodiment will be described. In this embodiment, the technique of estimating the oil ash deposition amount of the filter 1 is different.

[0061] In the preceding embodiment, the oil ash deposition amount was estimated based on the running distance of the vehicle, and the regeneration starting and stopping determination values were corrected accordingly, but in this embodiment, the following processing is performed.

[0062] When the oil ash deposition amount increases, the particulate collection amount when the differential pressure upstream and downstream of the filter 1 is the same will relatively decrease.

[0063] In this case, regeneration is performed when the filter differential pressure reaches a predetermined regeneration starting determination value, and even if regeneration is stopped when it has fallen to the regeneration stopping determination value, the processing time required for regeneration increases by the amount the actual particulate collection amount has decreased, and the temperature difference (outlet temperature - inlet temperature) between the inlet temperature and the outlet temperature of the filter 1 during regeneration becomes small. Thus, the output of the temperature sensor 4 at the inlet of the filter 1 and the output of the temperature sensor 5 at the outlet of the filter 1 during regeneration are compared, and the regeneration starting and regeneration stopping determination values are corrected using the correction values **Kmax**, **Kmin** as shown in Fig. 10.

[0064] Even if the differential pressure of the filter 1 is the same, the actual particulate collection amount decreases, i.e., the oil ash deposition amount increases, the less the temperature difference between the inlet temperature and outlet temperature of the filter 1. Therefore, the regeneration starting and regeneration stopping determination values are both corrected so that they are higher.

[0065] Even if the oil ash deposition amount increases with time, the " particulates which are actually collected can be increased to a predetermined set amount by increasing the regeneration determination values.

[0066] Fig. 11 shows the characteristics of the exhaust gas temperature at the inlet and outlet of the filter 1 when regeneration is performed. Regeneration starts at a time **t0**, the exhaust gas temperature at the inlet rises as shown by the solid line during the period Δ **t1**, and subsequently, a constant temperature is maintained during regeneration. On the other hand, as the particulates collected by the filter 1 burn, the exhaust gas temperature at the outlet shown by the dotted line becomes higher than the temperature at the inlet.

[0067] The temperature rise at the outlet side is slightly slower than the temperature rise at the inlet side, and after it eventually reaches a maximum temperature, the temperature starts to drop. During regeneration when the particulates are burning, the outlet temperature remains higher than the inlet temperature.

[0068] The difference between the inlet temperature and outlet temperature corresponding to the particulate combustion amount may for example be computed as the average temperature difference during the interval Δ**t1**, computed as a temperature difference of the inlet temperature **T1b** when the outlet has reached a maximum temperature **T2max**, or calculated as a temperature difference between an outlet temperature **T2a** and an inlet temperature **T1a** at a point **(t0 +** Δ **t1)** when a fixed time has elapsed from the start of regeneration.

[0069] A correction based on the temperature difference between the inlet and outlet may be performed instead of the correction of the regeneration starting determination value and regeneration stopping determination value based on the running distance by reading the vehicle running distance, which is performed in the steps S15, S16 of the flowchart of Fig. 2(B). The temperature difference at the filter inlet and outlet when regeneration is performed on the immediately preceding occasion is stored, and the regeneration starting and stopping determination values are corrected based thereon. The correction values are data obtained when the regeneration processing was performed on the immediately preceding occasion, but this approximates the latest situation and presents no problem in practice.

[0070] When the temperature difference at the filter inlet and outlet becomes small, the regeneration starting and stopping pressure determination values are respectively corrected so that they are increased. As a result, the pressure loss correction due to the effect of oil ash deposition is excluded, the regeneration determination values correspond to the particulate collection amount, and regeneration processing is always performed when the predetermined amount of particulates have collected. In this way, the time required for regeneration processing does not needlessly increase, and impairment of fuel cost-performance is suppressed as in the previous embodiment.

[0071] In this case, the filter 1 may be a catalyst support type.

[0072] Describing now a further embodiment, the oil ash deposition amount is estimated depending on the regeneration time of the filter 1, and the regeneration starting determination value and regeneration stopping determination value are respectively corrected thereby.

[0073] When the oil ash deposition amount increases, the particulate collection amount when the differential pressure of the filter reaches the regeneration starting determination value relatively decreases, the particulate combustion rate decreases and the processing time required for regeneration becomes longer. Hence, the re-

generation starting and stopping determination values are respectively corrected to become higher according to the regeneration processing time using the correction values **Kmax, Kmin** shown in Fig. 12.

[0074] The regeneration processing time is the time required from when regeneration starts to when it is determined that regeneration has stopped. This correction is also performed by the steps S15, S16 of the flowchart of Fig. 2(B). In this case, the regeneration starting and stopping determination values are corrected using the correction values based on the regeneration processing time on the immediately preceding occasion. In this way, oil ash deposition is excluded, and the regeneration of the filter 1 corresponds precisely to the particulate collection amount.

[0075] Describing now yet another embodiment, when the oil ash deposition amount increases, the particulate collection amount for the same differential pressure of the filter 1 decreases, so the particulate collection amount until regeneration processing is predicted from the running history to predict the regeneration starting and stopping determination values.

[0076] When the oil ash deposition amount increases, the particulate collection amount for the same pressure loss of the filter 1 decreases compared to the case when oil ash does not deposit. The particulate collection amount varies according to the running history of the engine, i.e., the engine rotation speed/load history. Fig. 13 shows the particulate discharge amount based on the engine rotation speed and load.

[0077] Therefore, by calculating the integral value of the particulate discharge amount per unit time until the next regeneration processing, the particulate collection amount can be estimated.

[0078] When the differential pressure reaches the regeneration determination value, if the particulate collection amount calculated from the running history is small, it means that the oil ash deposition amount is large. Hence, the regeneration starting and stopping determination values are corrected by the correction values **Kmax, Kmin** according to the particulate collection amount as shown in Fig. 14. In this case also, the regeneration starting and stopping determination amounts are corrected by correction values related to the particulate collection amount instead of the correction performed in the steps S15, S16 of the flowchart of Fig. 2.

[0079] As a result, by increasing the regeneration determination values the more the particulate collection amount decreases and the higher the estimated value of the oil ash deposition amount, the particulate collection amount up to next regeneration can be made to converge to a precise predetermined value.

[0080] In the above description, the pressure loss of the filter 1 was detected by a differential pressure sensor, but if the pressure fluctuation downstream of the filter is small, the pressure loss may also be estimated by detecting only the upstream exhaust gas pressure. It is also possible to detect both upstream and downstream exhaust gas pressure to estimate the pressure loss of the filter 1.

[0081] This invention is not limited to the aforesaid embodiments, various modifications being possible within the scope and spirit of the appended claims.

[0082] The entire contents of Japanese Patent Application P2001-28238(filed February 2, 2001) and P2002-4427(filed January 11, 2002) are incorporated herein by reference.

[0083] This invention is not limited to the above embodiments, various modifications being possible by those skilled in the art within the scope of the appended claims.

Claims

1. An engine exhaust purification device for a vehicle engine having a filter which collects particulates in an exhaust passage, comprising:

    a sensor which detects a differential pressure upstream and downstream of the filter,
    a sensor which detects an exhaust gas flow rate,
    a device which raises the exhaust gas temperature upstream of the filter, and
    a controller which functions to:

        estimate an oil ash deposition amount on the filter,
        set a regeneration determination value which performs regeneration of the filter based on the oil ash deposition amount and exhaust gas flow rate, and
        increase the exhaust gas temperature upstream of the filter to perform regeneration of the filter when it is determined that it is time to regenerate the filter by comparing the detected differential pressure and the regeneration determination value.

2. The exhaust purification device as defined in Claim 1, wherein the regeneration determination value has a regeneration starting determination value and regeneration stopping determination value, and the controller functions to start regeneration when the differential pressure reaches the regeneration starting determination value, and stop regeneration when the differential pressure decreases to the regeneration stopping determination value.

3. The exhaust purification device as defined in Claim 1, wherein the regeneration determination value is set to increase the larger the exhaust gas flow rate becomes.

4. The exhaust purification device as defined in Claim 3, wherein the exhaust gas flow rate is estimated based on the engine rotation speed and engine load.

5. The exhaust purification device as defined in Claim 1, wherein the regeneration determination value is set to increase the larger the oil ash the deposition amount becomes.

6. The exhaust purification device as defined in Claim 1, wherein the oil ash deposition amount is estimated based on the vehicle running distance.

7. The exhaust purification device as defined in Claim 1, wherein the oil ash deposition amount is estimated based on the engine running history.

8. The exhaust purification device as defined in Claim 7, wherein the engine running history is estimated based on the engine rotation speed and load history.

9. The exhaust purification device as defined in Claim 1, further comprising: sensors which detect the exhaust gas temperature upstream and downstream of the filter, and wherein the oil ash deposition amount is estimated based on the upstream and downstream exhaust gas temperature.

10. The exhaust purification device as defined in Claim 1, further comprising : means of measuring the regeneration processing time of the filter, and wherein the oil ash deposition amount is estimated based on the filter regeneration processing time.

11. The exhaust purification device defined in Claim 1, wherein the exhaust gas temperature raise device increases the exhaust gas temperature by delaying the fuel injection timing to the engine compared to the fuel injection timing in the normal running state.

12. The exhaust purification device as defined in Claim 1, wherein the exhaust gas temperature raise device increases the exhaust gas temperature by repeating fuel injection after performing a fuel injection to the engine in the normal running state.

13. The exhaust purification device as defined in Claim 1, wherein the differential pressures sensor comprises a pressure sensor disposed upstream of the filter, and the differential pressure is estimated based on the output of this pressure sensor.

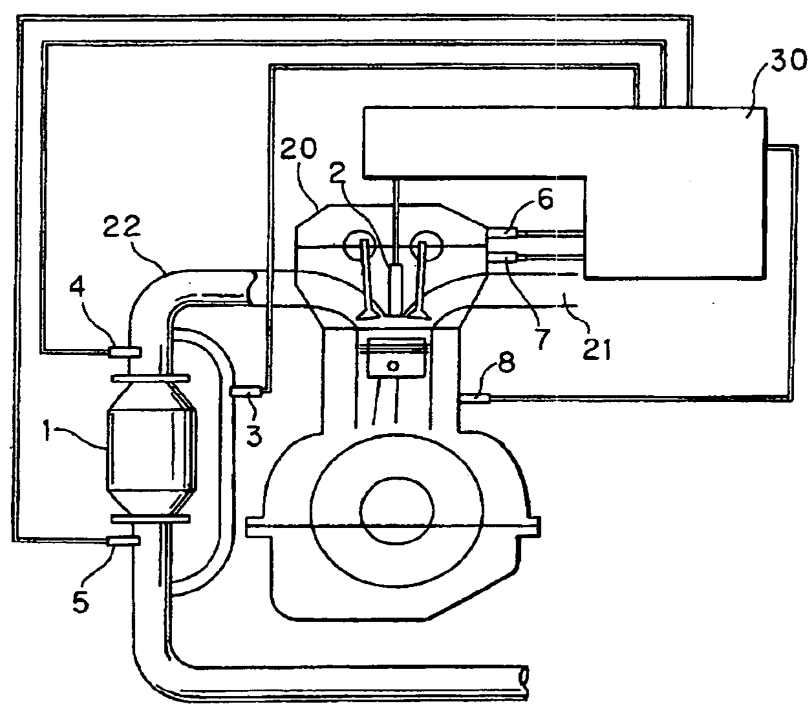

FIG.1

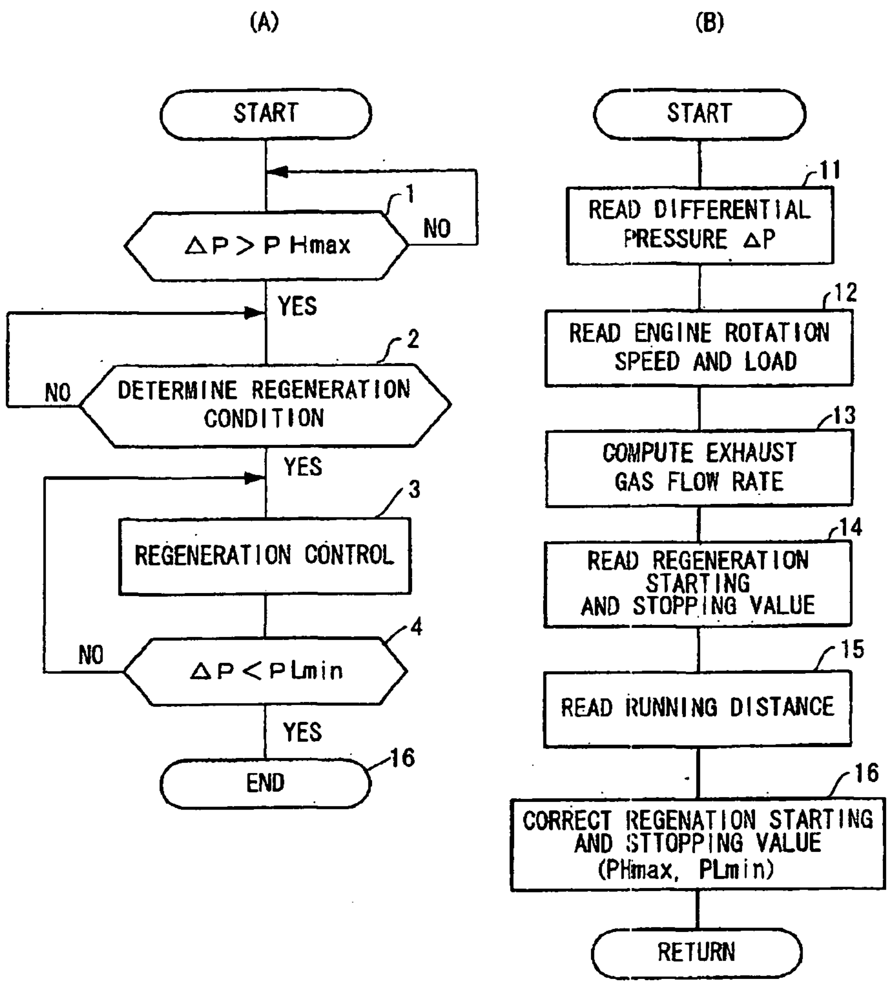
(A)
START
1
ΔP > P Hmax
NO
YES
2
DETERMINE REGENERATION CONDITION
NO
YES
3
REGENERATION CONTROL
4
ΔP < PLmin
NO
YES
16
END
(B)
START
11
READ DIFFERENTIAL PRESSURE ΔP
12
READ ENGINE ROTATION SPEED AND LOAD
13
COMPUTE EXHAUST GAS FLOW RATE
14
READ REGENERATION STARTING AND STOPPING VALUE
15
READ RUNNING DISTANCE
16
CORRECT REGENATION STARTING AND STTOPPING VALUE (PHmax, PLmin)
RETURN

FIG.2

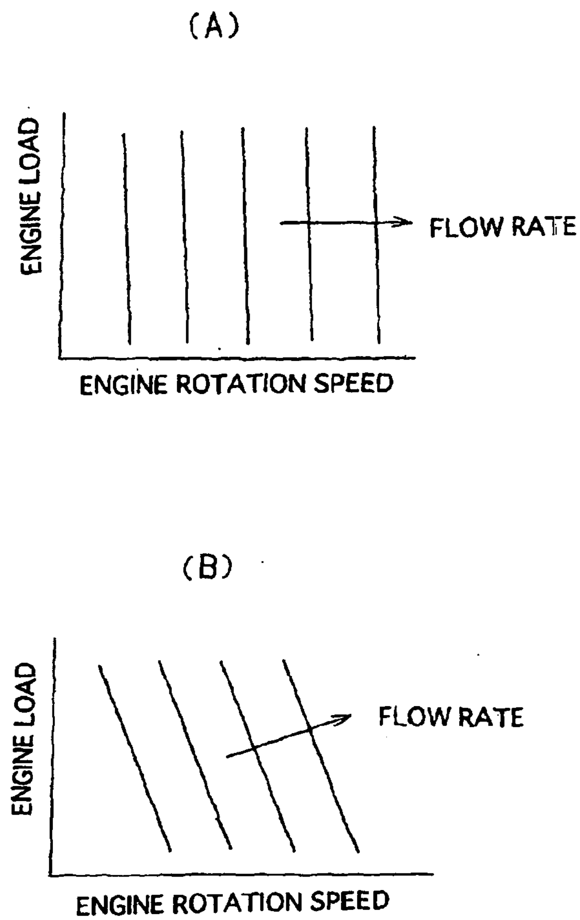
(A)
ENGINE LOAD
FLOW RATE
ENGINE ROTATION SPEED
(B)
ENGINE LOAD
FLOW RATE
ENGINE ROTATION SPEED

FIG.3

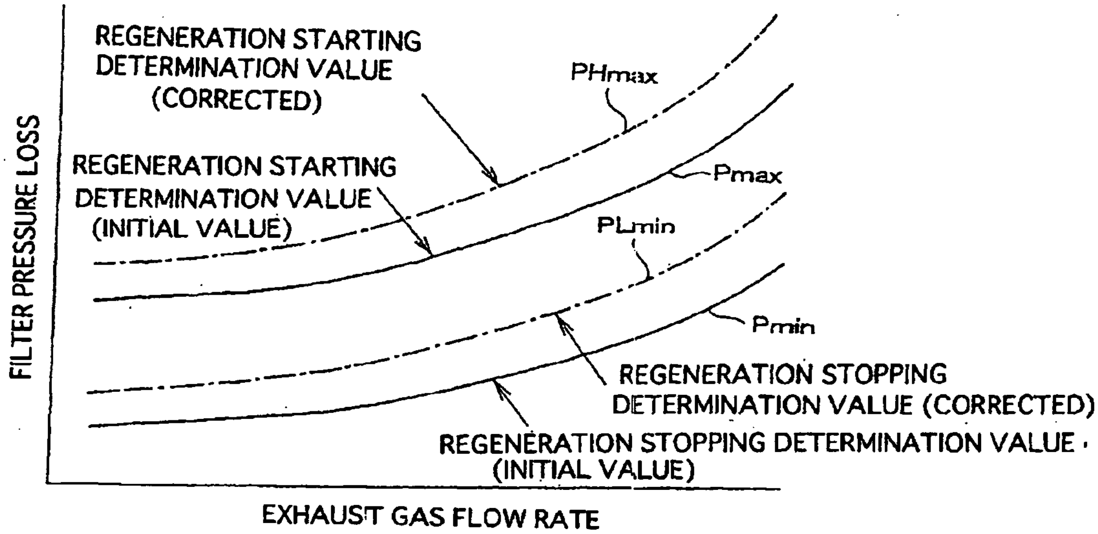
REGENERATION STARTING DETERMINATION VALUE (CORRECTED)
PHmax
REGENERATION STARTING DETERMINATION VALUE (INITIAL VALUE)
Pmax
PLmin
Pmin
FILTER PRESSURE LOSS
REGENERATION STOPPING DETERMINATION VALUE (CORRECTED)
REGENERATION STOPPING DETERMINATION VALUE (INITIAL VALUE)
EXHAUST GAS FLOW RATE

FIG.4

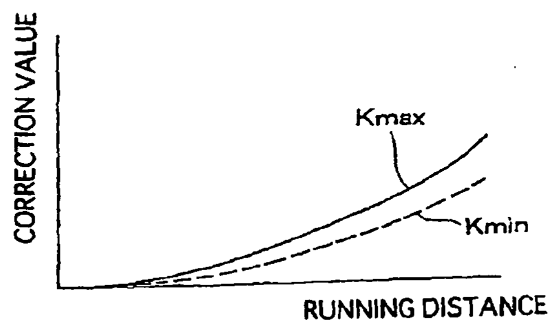

FIG.5

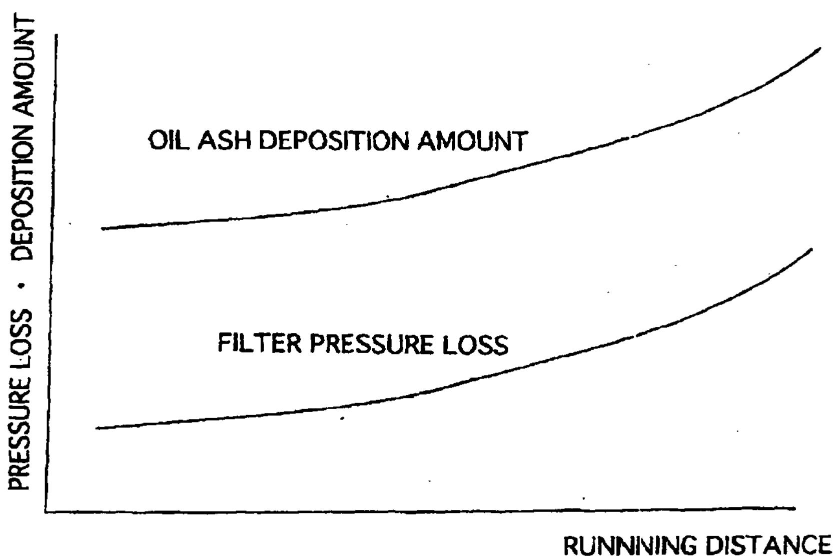
PRESSURE LOSS · DEPOSITION AMOUNT
OIL ASH DEPOSITION AMOUNT
FILTER PRESSURE LOSS
RUNNNING DISTANCE

FIG.6

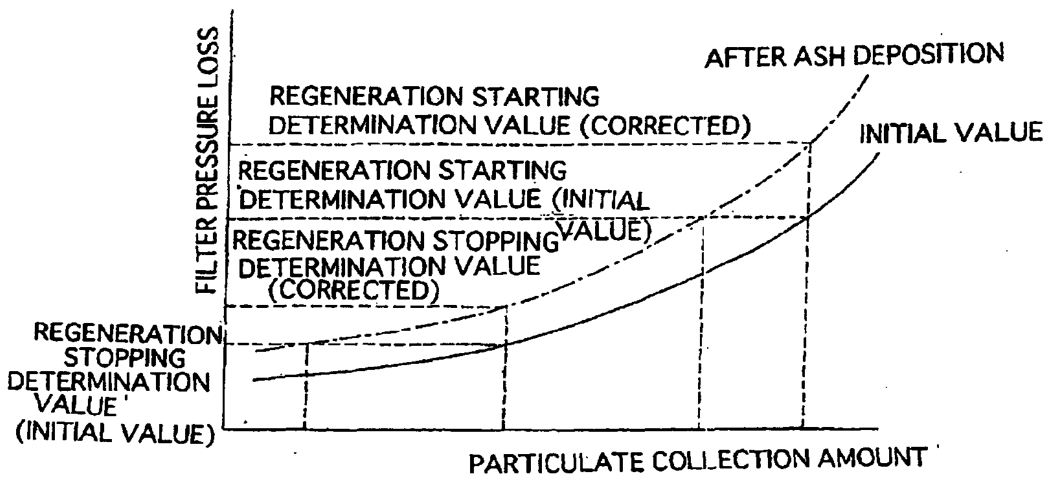
FILTER PRESSURE LOSS
AFTER ASH DEPOSITION
REGENERATION STARTING DETERMINATION VALUE (CORRECTED)
INITIAL VALUE
REGENERATION STARTING DETERMINATION VALUE (INITIAL VALUE)
REGENERATION STOPPING DETERMINATION VALUE (CORRECTED)
REGENERATION STOPPING DETERMINATION VALUE (INITIAL VALUE)
PARTICULATE COLLECTION AMOUNT

FIG.7

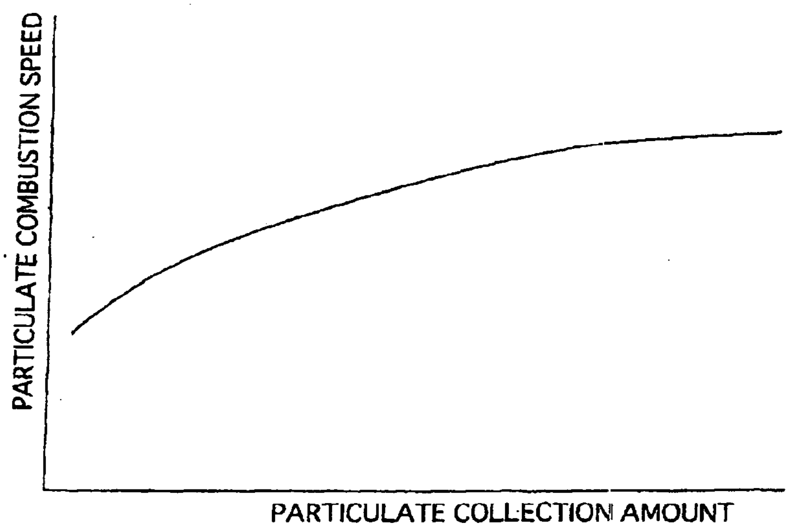
PARTICULATE COMBUSTION SPEED
PARTICULATE COLLECTION AMOUNT

FIG.8

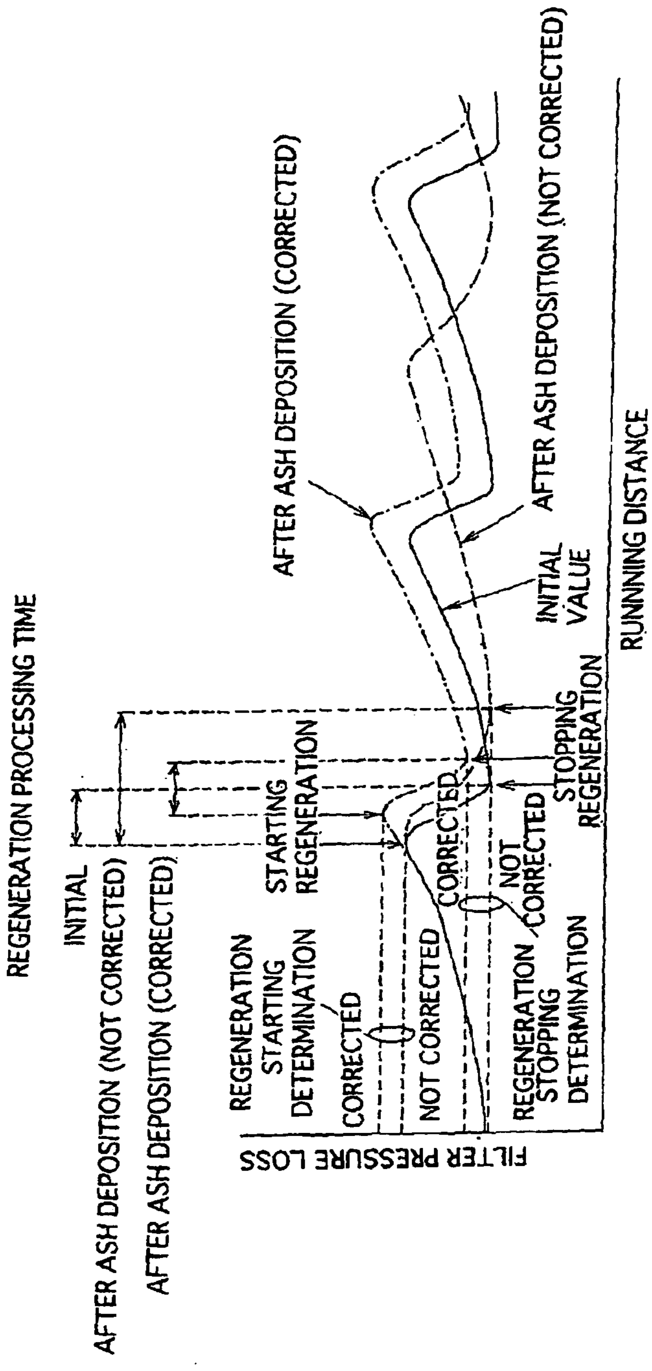
REGENERATION PROCESSING TIME
INITIAL
AFTER ASH DEPOSITION (NOT CORRECTED)
AFTER ASH DEPOSITION (CORRECTED)
FILTER PRESSURE LOSS
REGENERATION STARTING DETERMINATION
CORRECTED
NOT CORRECTED
REGENERATION STOPPING DETERMINATION
STARTING REGENERATION
CORRECTED
NOT CORRECTED
STOPPING REGENERATION
AFTER ASH DEPOSITION (CORRECTED)
AFTER ASH DEPOSITION (NOT CORRECTED)
INITIAL VALUE
RUNNING DISTANCE

FIG.9

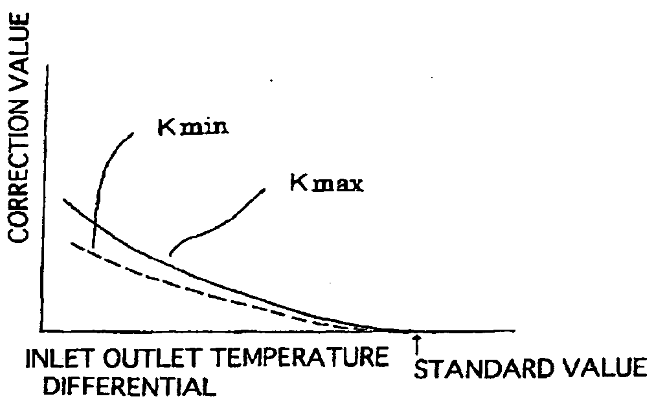
CORRECTION VALUE
Kmin
Kmax
INLET OUTLET TEMPERATURE DIFFERENTIAL
STANDARD VALUE

FIG.10

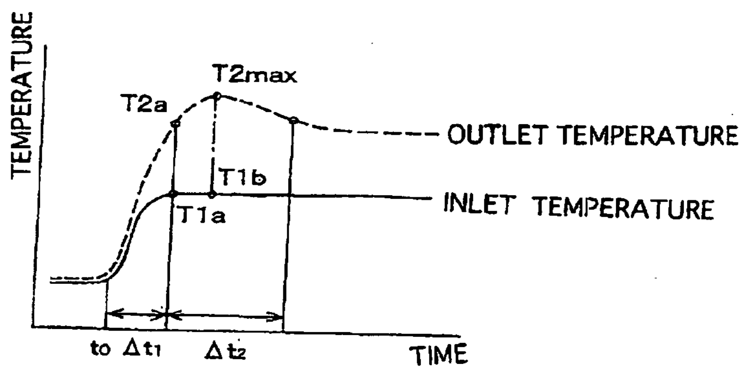
TEMPERATURE
T2max
T2a
OUTLET TEMPERATURE
T1b
INLET TEMPERATURE
T1a
to Δt1
Δt2
TIME

FIG.11

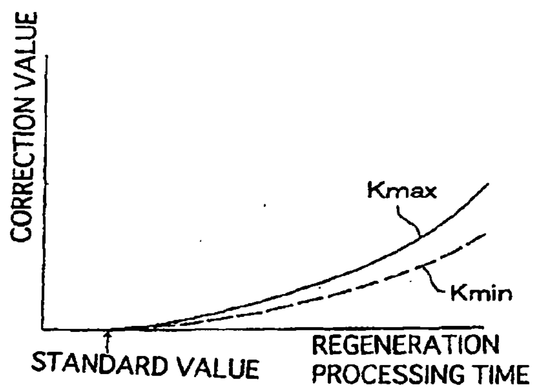
CORRECTION VALUE
Kmax
Kmin
STANDARD VALUE
REGENERATION
PROCESSING TIME

FIG.12

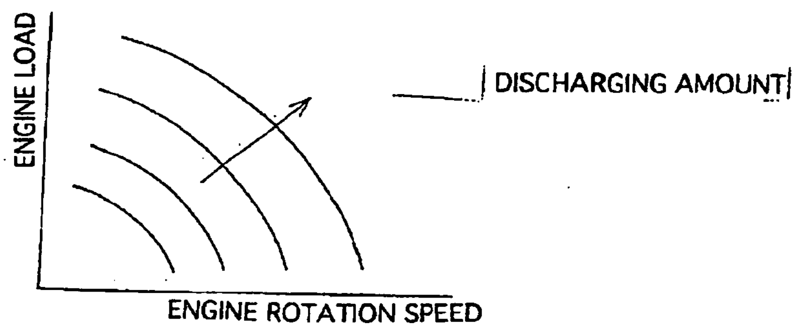

FIG.13

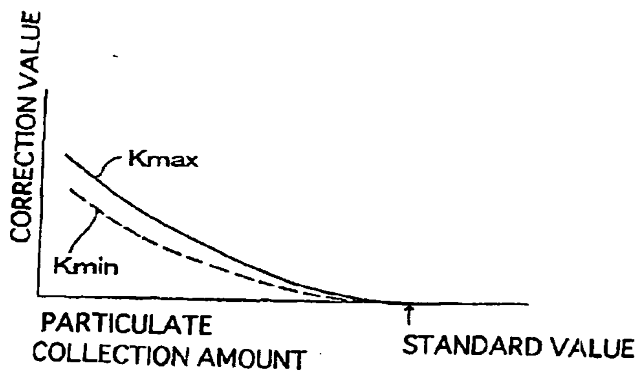
CORRECTION VALUE
Kmax
Kmin
PARTICULATE
COLLECTION AMOUNT
STANDARD VALUE

FIG.14

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EUROPEAN SEARCH REPORT

Application Number
EP 02 00 2551

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	22 March 2002	Ikas, G

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